Development and Testing of Hollow-Core Retrofits

F. Bueker[1*], M. Parr[2**], N. Brooke[3], D. Bull[4], E. d. R. Castillo[1], K. Elwood[1], R. Henry[1], L. Hogan[1], A. Liu[5], M. Mostafa[1], A. Sarkis[2], T. Sullivan[2]

[1] University of Auckland, [2] University of Canterbury, [3] Compusoft Engineering, [4] Holmes Consulting, [5] Branz

* fbke427@aucklanduni.ac.nz, ** michael.parr@pg.canterbury.ac.nz

1) Introduction

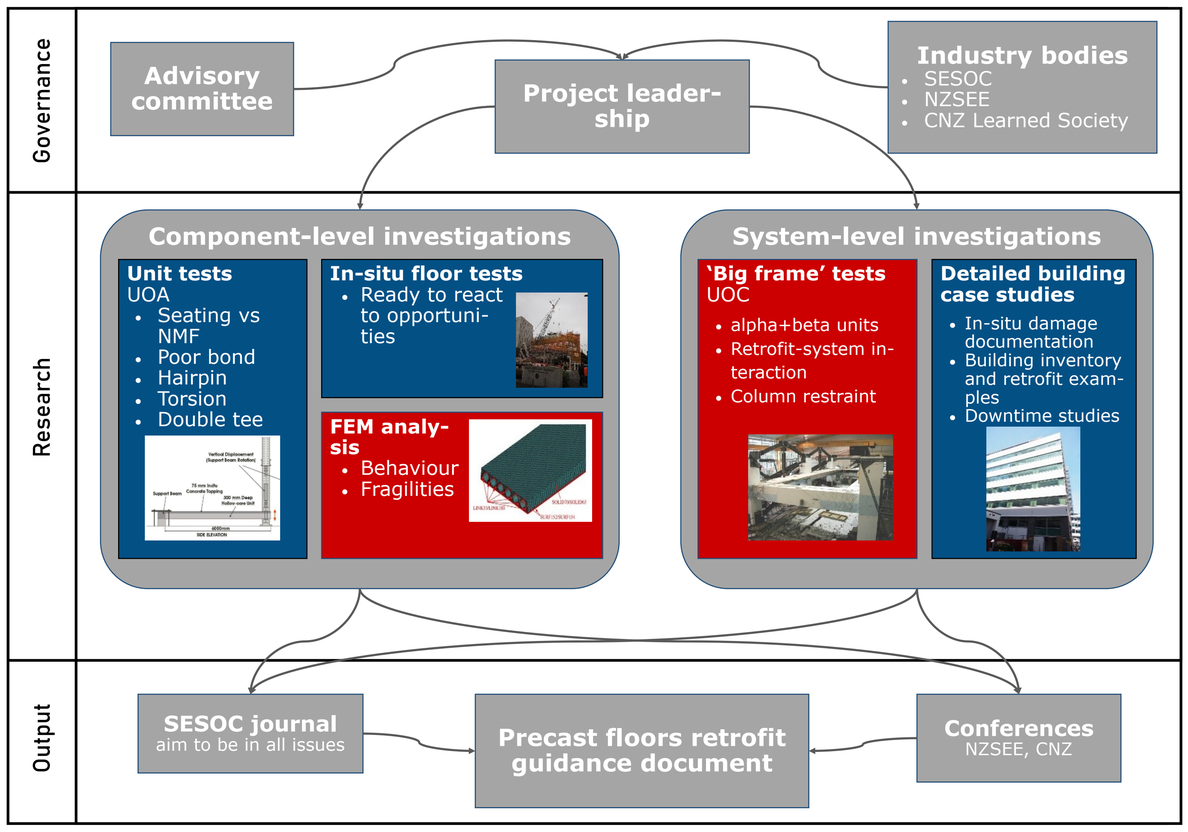
Precast, prestressed hollow-core floors are the predominant flooring system in New Zealand's multi-storey building stock. Assessments of buildings in Wellington after the 2016 Kaikoura Earthquake exposed significant vulnerabilities of **hollow-core floors in Pre-2000 buildings**.

Following those assessments, the **"ReCast Floors" research project** has been initiated with the objectives to

- develop a better understanding of the hollow-core floor performance,
- improve assessment methods and
- propose suitable retrofit solutions.

This poster mainly focuses on the **experimental testing** conducted and planned within the scope of the ReCast Floors project.

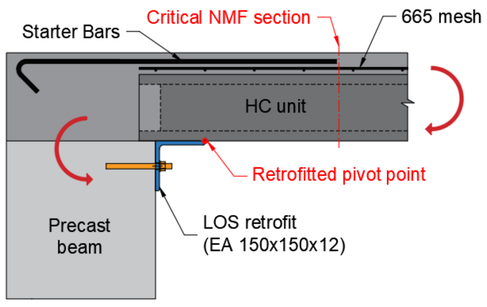
2) ReCast Floors - Project Overview



3) Experimental Investigation

A series of tests has been conducted[1] to investigate

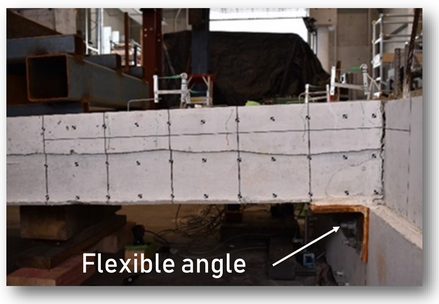
- **detrimental effects of loss of seating (LOS) retrofits** on beam to floor connec-tion performance
- **Retrofit solutions** to prevent negative moment failure (NMF) and
- Performance with **different seating angle positions.**

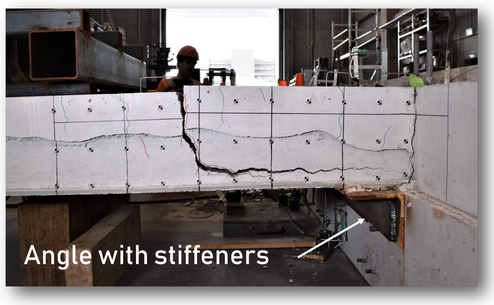


Tested beam to floor connection with seating angle as a LOS retrofit

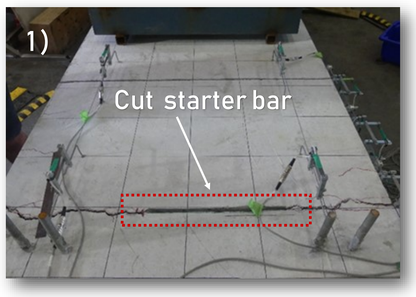
Key Findings:

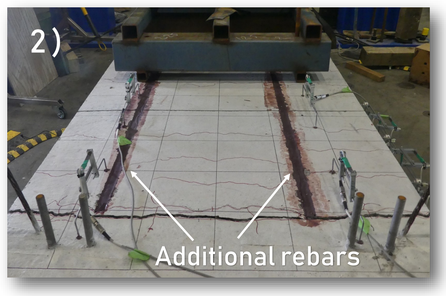
- **Stiffness of the seating angle retrofit** was found to be an important factor to whether a NMF was triggered or not.





- Successfully tested retrofit solutions are:
  1) Cutting of starter bars at the beam to floor interface
  2) Strengthening the critical section with post-installed rebars
  3) Dropping the seating angle





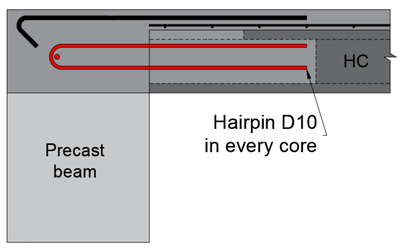
[1] Described testing conducted by M. Parr

4) Future Research/Outlook

◊ **Sub-assembly testing (Component test):**

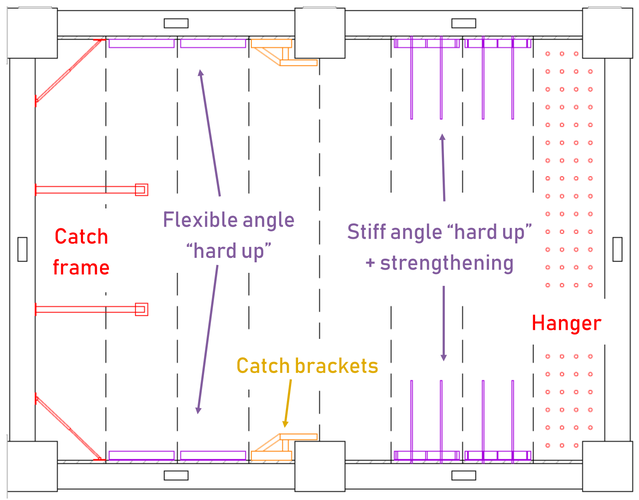
- Hairpin reinforcement
- Short, strong starter bars

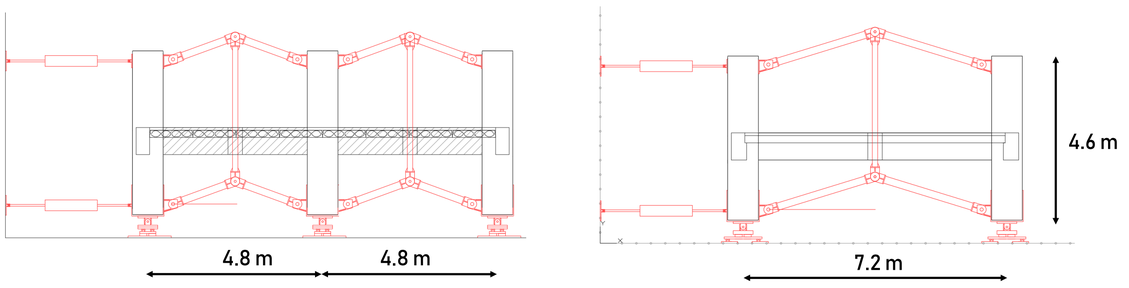
} Testing for NMF and ex-ploring more retrofit options



◊ **Super-assembly test :**

- Verification of proposed retrofit solutions from component test
- Alpha & beta unit retrofit testing
- Retrofit-system interaction





Super-assembly specimen

◊ Effect of **poorly bonded prestressing strands** on the seismic perfor-mance of hollow-core floors

- Detection
- Positive Moment Retrofit

Acknowledgement:

BRANZ · QuakeCoRE NZ Centre for Earthquake Resilience · EQC Earthquake Commission Kōmihana Rūwhenua · concretenz Learned Society